Idaho National Laboratory
GMD Workshop

August 27 , 2013

Astronomy Picture of the Day
2000 November 27
http://antwrp.gsfc.nasa.gov/apod/astropix.html

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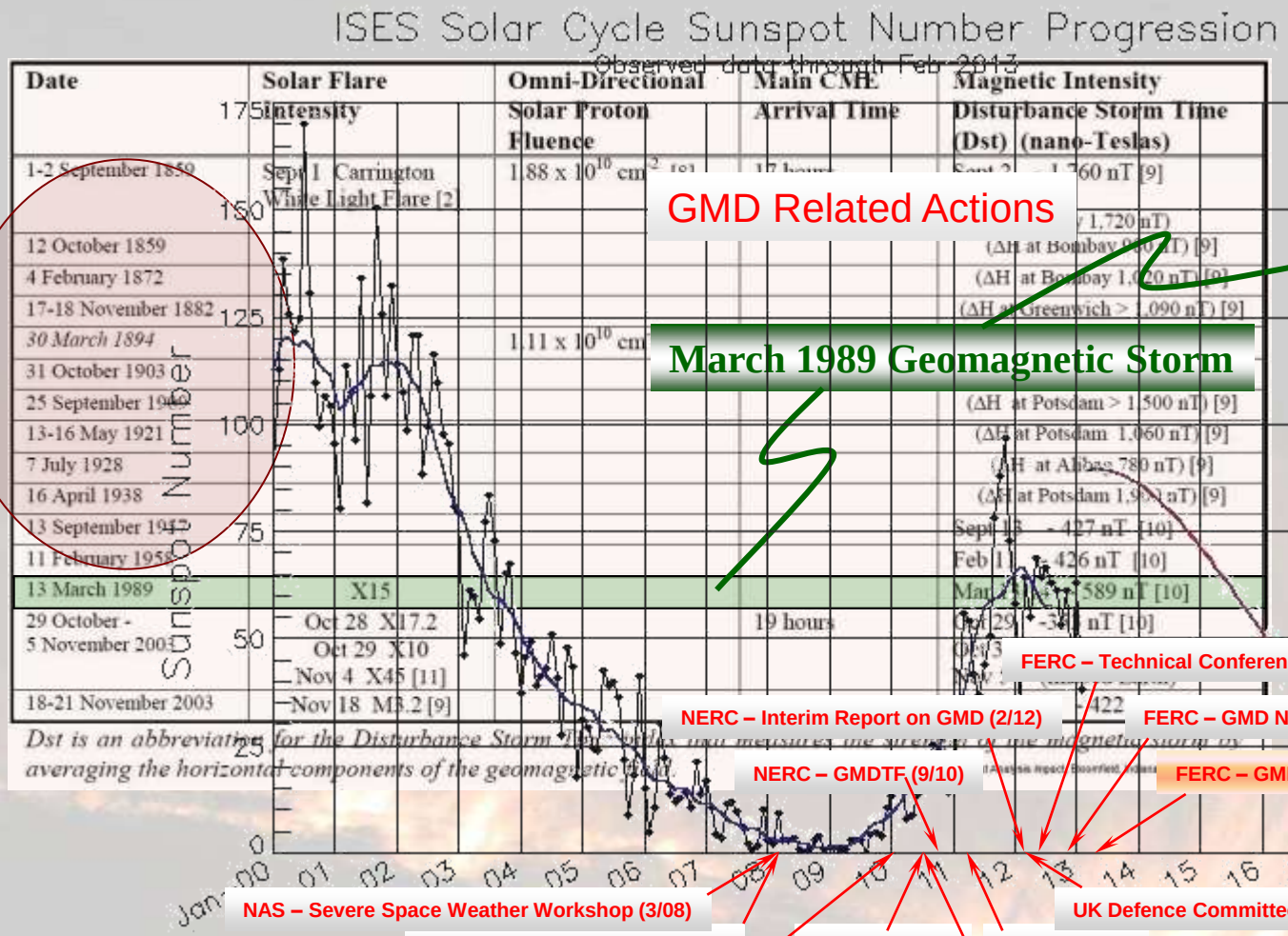
Geomagnetic Storm Levels



Date	Solar Flare Intensity	Omni-Directional Solar Proton Fluence	Main CME Arrival Time	Magnetic Intensity Disturbance Storm Time (Dst) (nano-Teslas)
1-2 September 1859	Sept 1 Carrington White Light Flare [2]	1.88 x 10^{10} cm^{-2} [8]	17 hours	Sept 2 - 1,760 nT [9]
12 October 1859				(ΔH at Bombay 1,720 nT)
4 February 1872				(ΔH at Bombay 1,600 nT) [9]
17-18 November 1882				(ΔH at Bombay 1,020 nT) [9]
30 March 1894		1.11 x 10^{10} cm		(ΔH at Greenwich > 1,090 nT) [9]
31 October 1903				
25 September 1909				(ΔH at Potsdam > 1,500 nT) [9]
13-16 May 1921				(ΔH at Potsdam 1,060 nT) [9]
7 July 1928				(ΔH at Alibag 780 nT) [9]
16 April 1938				(ΔH at Potsdam 1,900 nT) [9]
13 September 1941				Sept 18 - 427 nT [10]
11 February 1958				Feb 11 - 426 nT [10]
13 March 1989	X15			Mar 13 - 589 nT [10]
29 October - 5 November 2003	Oct 28 X17.2 Oct 29 X10 Nov 4 X45 [11]		19 hours	Oct 29 - 383 nT [10]
18-21 November 2003	Nov 18 M3.2 [9]			Nov 20 - 422

Dst is an abbreviation for the Disturbance Storm Time index and measures the presence of the magnetic storm by averaging the horizontal components of the geomagnetic field.

GMD Related Actions

March 1989 Geomagnetic Storm

FERC – Technical Conference on GMD (4/12)

NERC – Interim Report on GMD (2/12)

FERC – GMD NOPR (10/12)

NERC – GMDTF (9/10)

FERC – GMD Order 779 (5/13)

NAS – Severe Space Weather Workshop (3/08)

UK Defence Committee EMP Threats (2/12)

EMP Commission Report (4/08)

HR 5026 (6/10)

HR 668 (2/11)

ORNL – Metatech Report (1/10)

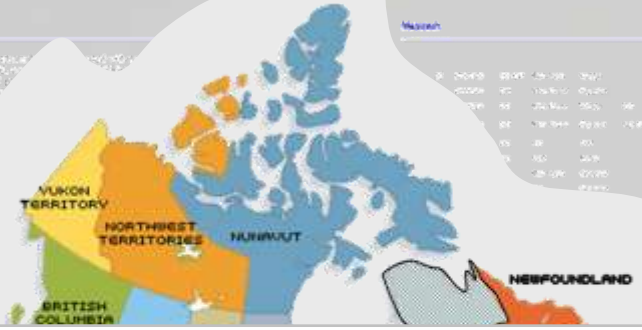
NERC/DOE – HILF REPORT (6/10)

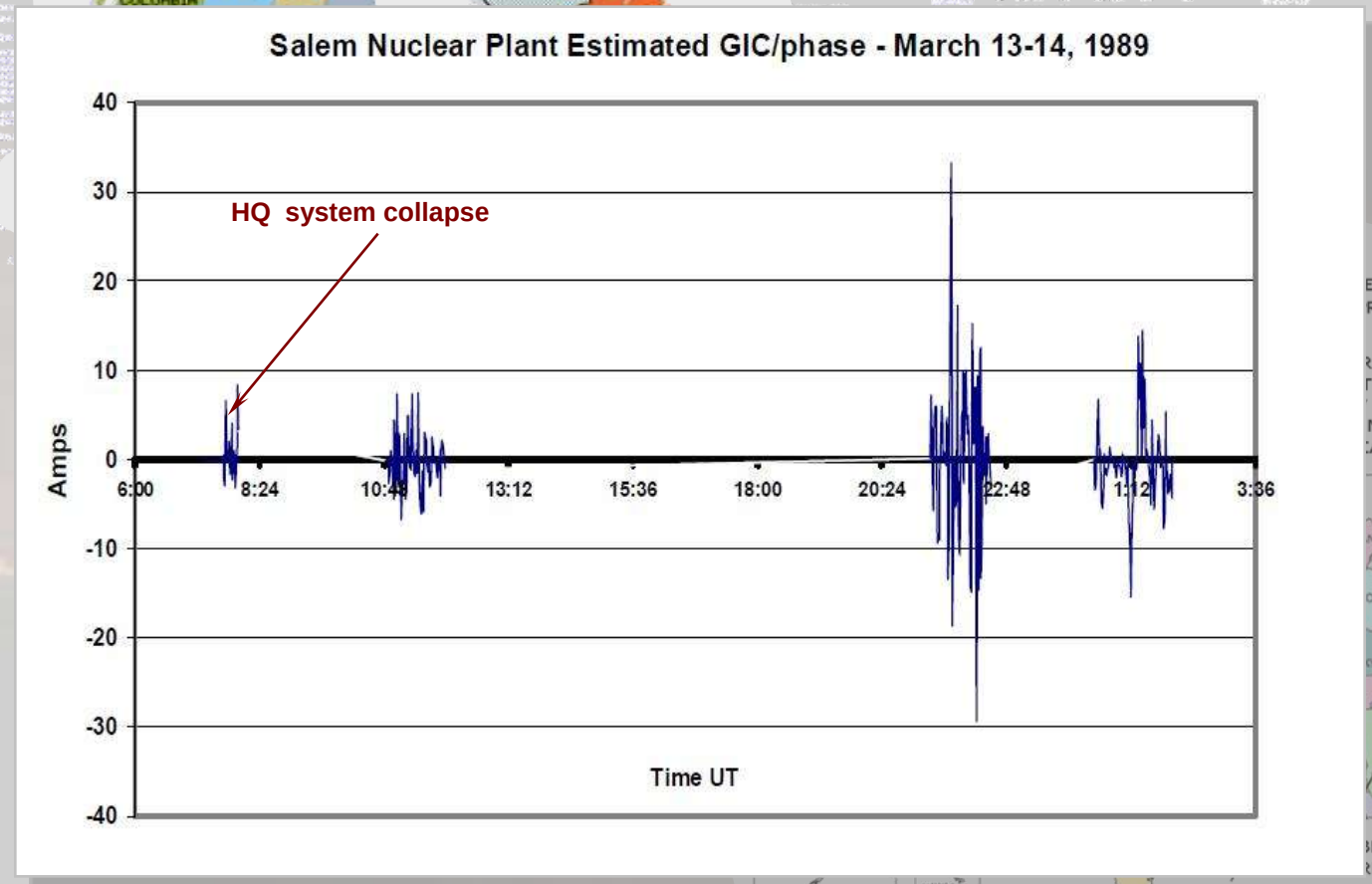
Table 4: Top 30 geomagnetic storms based on Potsdam running Ap

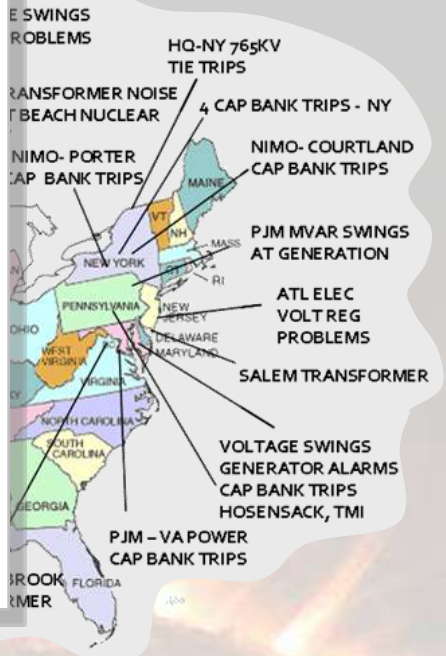
Rank	Ap	Date
1	312	09/18/1941
2	293	11/12/1960
3	285	03/13/1989
4	277	03/24/1940
5	258	10/06/1960
6	**252**	**10/29/2003**
7	252	07/15/1959
8	251	03/31/1960
9	241	05/25/1967
10	229	07/13/1982
11	228	02/07/1986
12	226	03/29/1940
13	223	08/04/1972
14	222	07/05/1941
15	221	09/04/1957
16	**221**	**10/30/2003**
17	216	07/08/1958
18	214	03/28/1946
19	212	09/22/1946
20	212	03/01/1941
21	212	07/26/1946
22	210	08/19/1950
23	201	09/06/1982
24	199	02/07/1946
25	199	02/11/1958
26	196	05/12/1949
27	196	06/04/1991
28	195	03/24/1946
29	193	05/10/1992
30	192	07/15/2000

Source: NOAA Technical Memorandum OAR SEC-88
HALLOWEEN SPACE WEATHER STORMS OF 2003

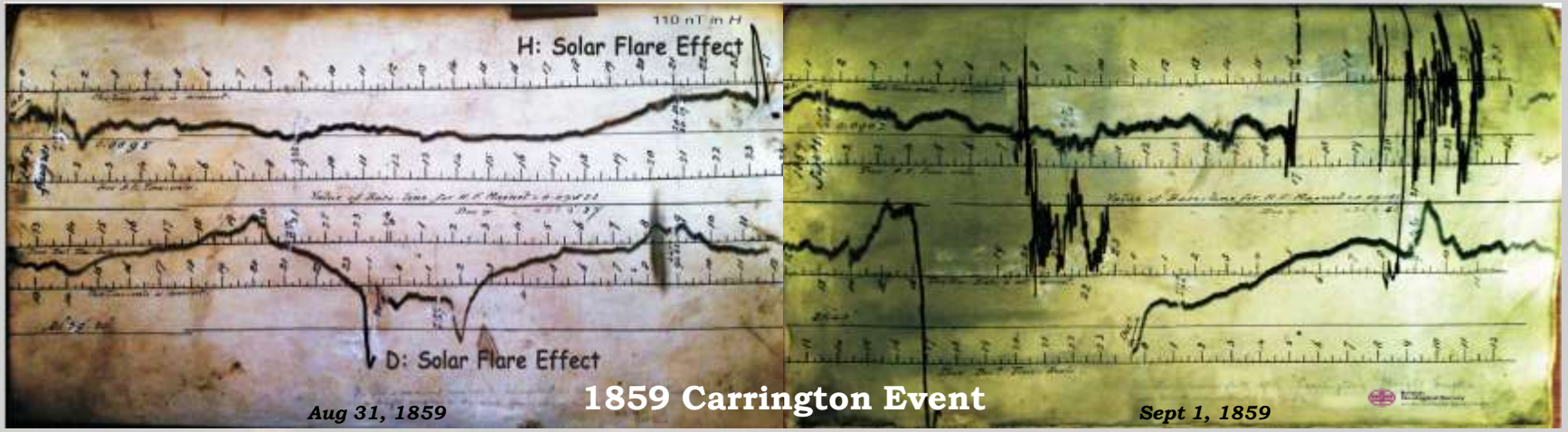
1989 North American Impacts

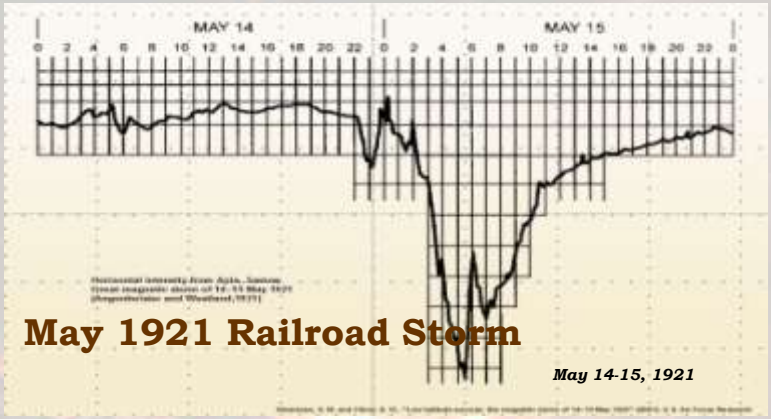




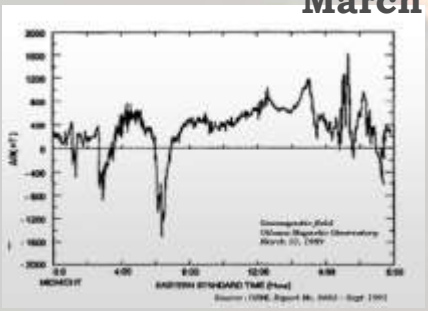


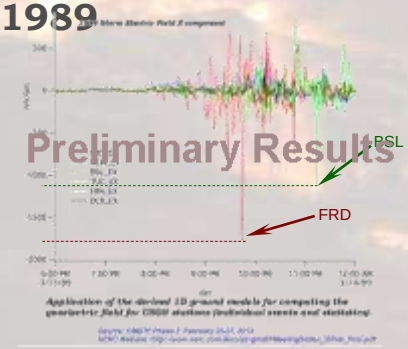
Geomagnetic Storm Comparison

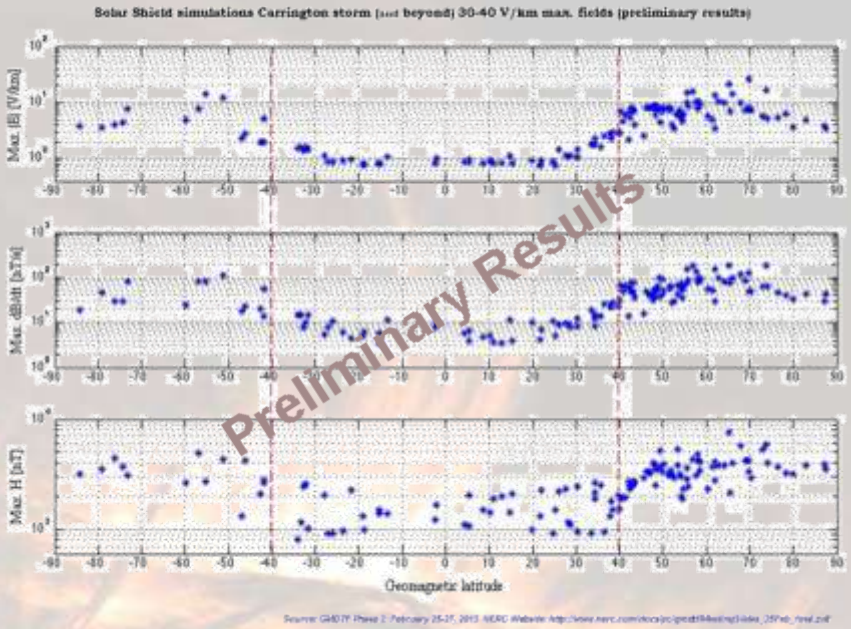




March 1989

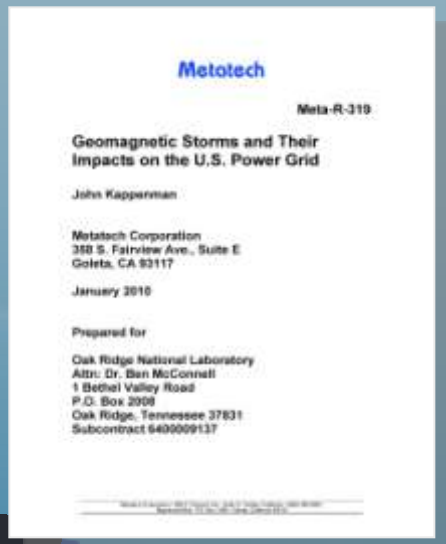


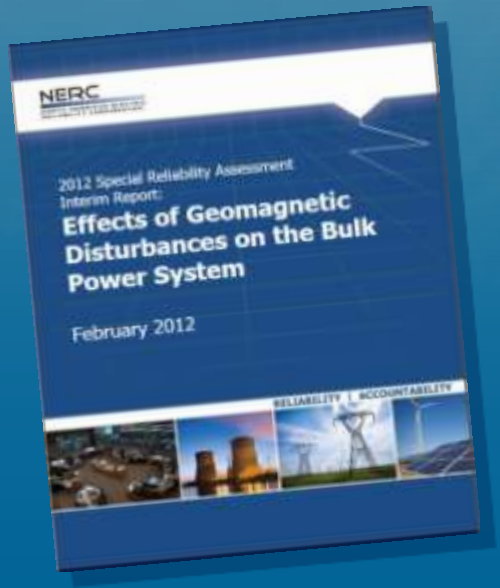




E and H Field Simulation (1859)

Reports Relating Geomagnetic Disturbances to Electric Grid Impacts





Chronology of Major Incidents

- March 24, 1940 – widespread disturbances, equipment trips, voltage swings
- September 22, 1957 – numerous disturbances
- February 11, 1958 – Toronto blackout, numerous other disturbances
- August 4, 1972 – numerous effects
- October 1980 – 500 kV line trip
- April 1981 – 500 kV line trip
- July 31, 1982 – four transformers and 15 lines tripped
- February 7-8, 1986 – numerous effects
- March 13-14, 1989 – Hydro-Quebec blackout, widespread problems, transformer damage
- September 1989 – voltage problems and relay misoperation
- March 24, 1991 – nine line trips, transformer trip, Quebec-New England line trip
- October 28, 1991 – line trip Quebec to New England
- April 3, 1994 – Transformer failures
- May 2, 1998 – widespread effects
- July 22, 1998 – effects in Northeastern U.S.
- April 6-7, 2000 – numerous problems on Hydro-Quebec and Bonneville
- July 15, 2000 – multiple equipment trip incidents in Northeast U.S.
- November 6, 2001 – New Zealand transformer loss
- October 2003 – Malmo blackout, Transformer damage in South Africa, preventive actions taken in the U.S. appear to circumvent major problems

James Bay - 1980

James Bay - 1980

Norwich Main - 1989

Meadowbrook #4 - 1989

Halfway Bush T4 – 2002 NZ

Halfway Bush T4 – 2002 NZ

Eskom

Sta 1 GSU #8 - 1989

Sta 2 Trfr #1 - 2003

Sta 2 GSU #4 - 1991

Sta 2 Trfr #1 - 2003

Sta 3 Trfr #1 - 2003

Sta 2 Trfr #2 - 2003

Sta 3 Trfr #2 - 2003

Sta 3 Trfr #4 - 2003

Sta 3 Trfr #3 - 2003

Sta 3 Trfr #4 - 2003

Sta 3 Trfr #5 - 2003

Sta 4 Trfr #6 - 2003

Sta 3 Trfr #6 - 2003

Sta 5 Trfr 2 - 2003

James Bay	2	Canada
Salem	3	USA
Meadow Brook	1	USA
Nat Grid	2	UK
Transpower	2	New Zealand
Eskom	14	So Africa

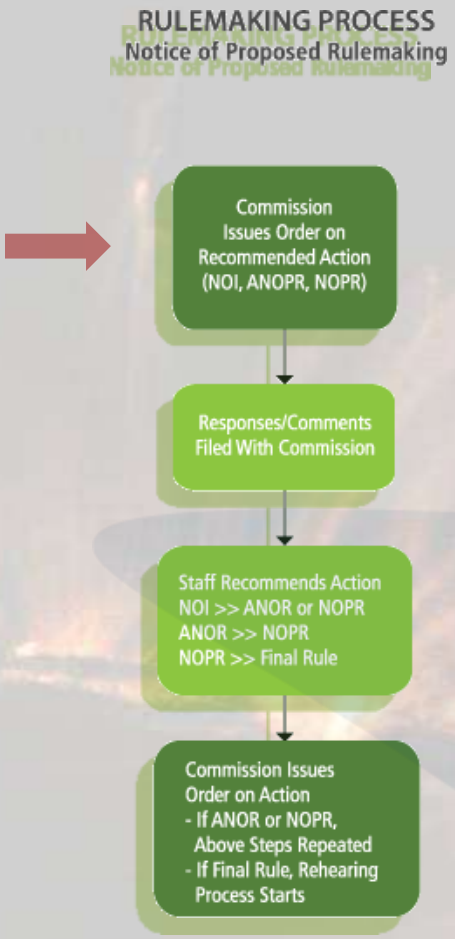
NOAA Space Weather Prediction Center

GMD Technical Conference

- Space weather events more severe that we have experienced in modern times have occurred in the past and are likely to occur again
- Large power transformers are unique in their design and you can not make blanket judgments as to whether a particular type or group of transformers will or will not be damaged.
- While there is agreement that reactive power requirements will influence system stability, we do not know at exactly what level it will cause the system to collapse
- In the end, it is indeterminable if transformer damage, system collapse or both will be the most likely consequence of a GMD event; we simply lack the information to draw either conclusion.
- Neither system collapse nor extensive transformer failure is an acceptable result of a GMD event when we have the capability to act to prevent it

Notice of Proposed Rulemaking

Reliability Standards for Geomagnetic Disturbances



DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

18 CFR Part 40

[Docket No. RM12–22–000]

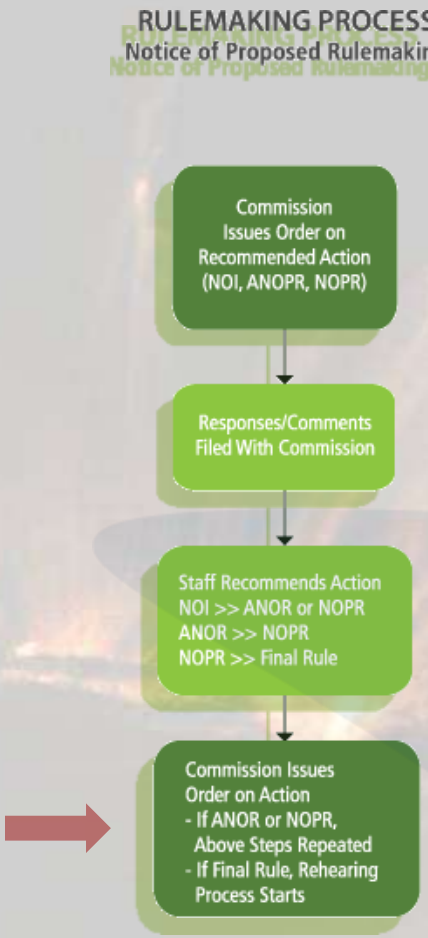
Reliability Standards for Geomagnetic Disturbances

AGENCY: Federal Energy Regulatory Commission, DOE.

ACTION: Notice of Proposed Rulemaking.

Final Rule - Order 779

Reliability Standards for Geomagnetic Disturbances



DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

18 CFR Part 40

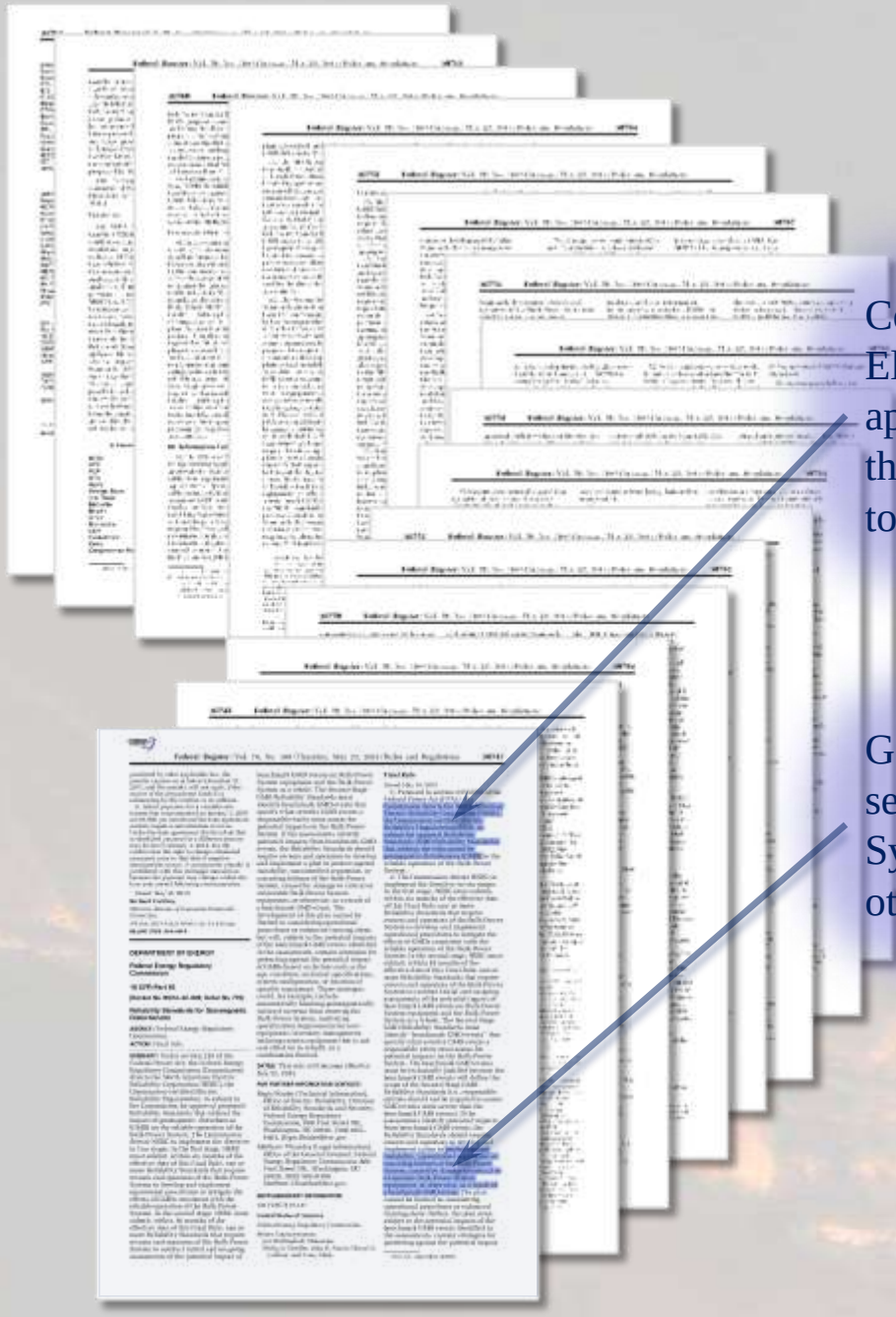
[Docket No. RM12–22–000; Order No. 779]

Reliability Standards for Geomagnetic Disturbances

AGENCY: Federal Energy Regulatory Commission.

ACTION: Final rule.

Final Rule – Order No. 779
Reliability Standards for Geomagnetic Disturbances

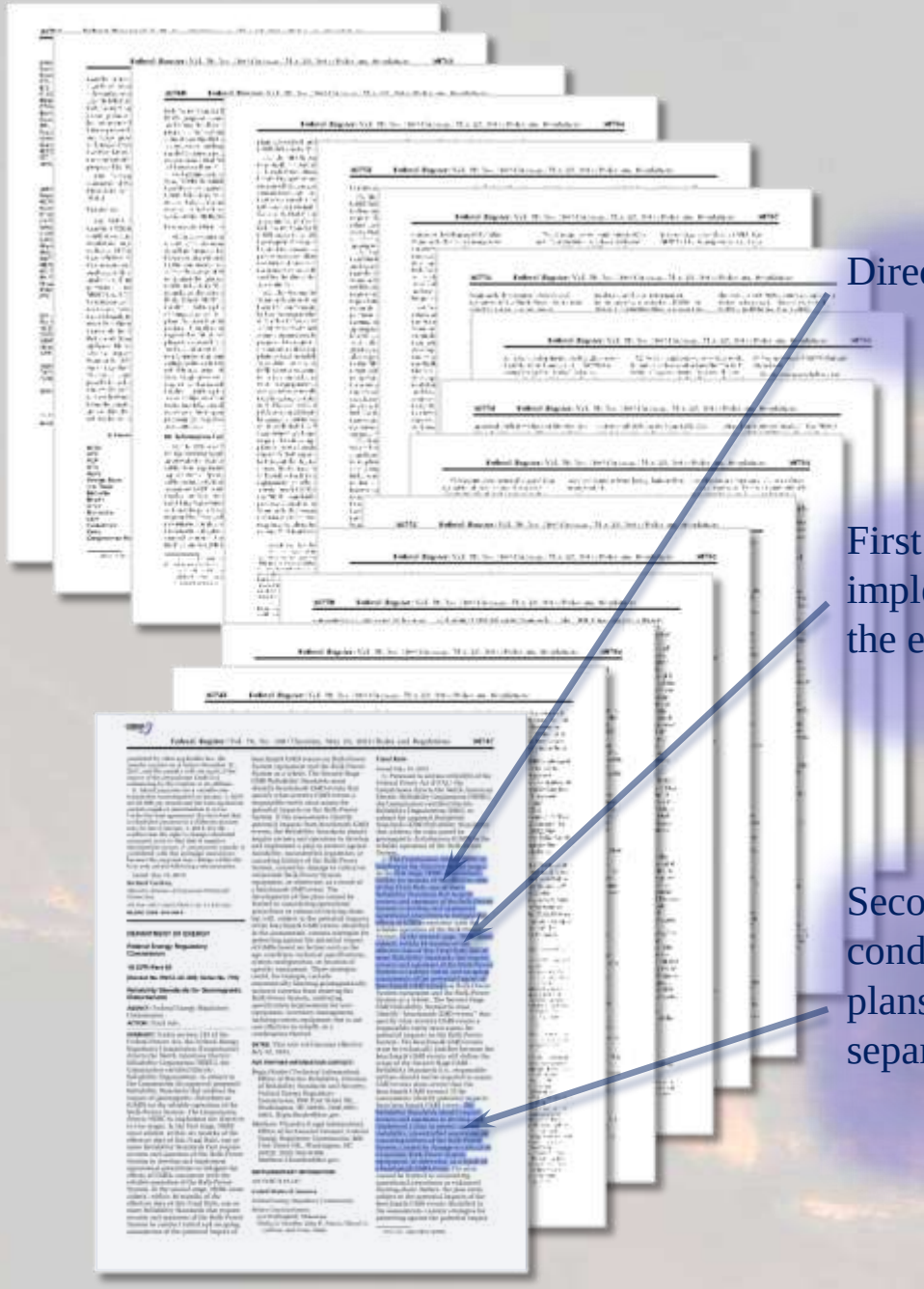


Commission directs the North American Electric Reliability Corporation to submit for approval Reliability Standards that address the risks posed by geomagnetic disturbances to the Bulk Power System

Goal is to protect against instability, uncontrolled separation, or cascading failures of the Bulk-Power System caused by damage to equipment or otherwise.

Federal Register/Vol. 78, No. 100

Final Rule – Order No. 779
Reliability Standards for Geomagnetic Disturbances



Directive to be implemented in two stages

First stage requires development and implementation of operating procedures to mitigate the effects of GMD

Second stage requires owners and operators to conduct assessments and develop and implement plans to protect against instability, uncontrolled separations and cascading failures.

Stage One

Federal Register / Vol. 78, No. 100 / Thursday, May 23, 2013 / Rules and Regulations 30753

35. Commenters generally agree that operational procedures, if required, should be developed by responsible entities and not by NERC, although some commenters state that NERC could develop best practices to assist responsible entities.[64] Commenters state that the Reliability Standards should not have Requirements that treat responsible entities the same ["one-size-fits-all"] because responsible entities, due to geography, geology or other variables, may be more or less likely to experience the effects of GMDs. Commenters state that the operational procedures should be developed by responsible entities based on factors such as the entity's geographic location and the structural make-up of the entity's Bulk-Power System components. Commenters also state that operational procedures should not have the unintended effect of adversely impacting the Bulk-Power System. Commenters further state that the Reliability Standards should be clear as to which functional entities are responsible for compliance and that the assignment of responsibilities should be consistent with NERC's functional model.

Commission Determination

36. The Commission directs NERC to submit, within six months of the effective date of this Final Rule, one or more Reliability Standards requiring owners and operators of the Bulk-Power System to develop and implement operational procedures to mitigate the effects of GMDs consistent with the reliable operation of the Bulk-Power System. As we stated in the NOPR, "operational procedures, while not a complete solution, constitute[] an important first step to addressing the GMD reliability gap because they can be implemented relatively quickly."[65] Operational procedures may help alleviate abnormal system conditions due to transformer absorption of reactive power during GMD events, helping to stabilize system voltage swings, and may potentially isolate some equipment from being damaged or misoperated.

37. It is not premature for NERC to begin developing Reliability Standards requiring owners and operators of the Bulk-Power System to develop and implement operational procedures. The comments reflect that some entities have implemented operational procedures to mitigate the impacts of GMDs.[66] In addition, the NERC Interim GMD Report identifies examples of operational procedures to mitigate GMD events including: reduction of equipment loading (e.g., by starting off-line generation), unloading the reactive load of operating generation, reductions of system voltage, and system and/or equipment isolation through reconfiguration of the transmission system.[67] In addition, the NERC GMD Task Force has developed operational procedure templates for certain functional entities. Given the work of the NERC GMD Task Force and recognizing that some operational procedures are already in place, we conclude that it is not premature for NERC to develop Reliability Standards that require operational procedures.

38. The Commission is not directing NERC to develop Reliability Standards that include specific operational procedures. Instead, as proposed in the NOPR, the Reliability Standards should include a mechanism that requires responsible entities to develop and implement operational procedures because owners and operators of the Bulk-Power System are most familiar with their own equipment and system configurations. In addition, we do not expect that owners and operators of the Bulk-Power System will necessarily develop and implement the same operational procedures. Instead, the Reliability Standards, rather than include "one-size-fits-all" Requirements, should allow responsible entities to tailor their operational procedures based on the responsible entity's assessment of entity-specific factors, such as geography, geology, and system topology, identified in the Reliability Standards. In addition, as we stated in the NOPR, the coordination of operational procedures across regions is an important issue that should be considered in the NERC standards development process.[68] The coordination of operational procedures across regions and data sharing might be overseen by planning coordinators or another functional entity with a wide-area perspective.[69] The NERC standards development process, as stated in the NOPR, should also consider operational procedures for restoring GMD-impacted portions of the Bulk-Power System that take into account the potential for damaged equipment that could be de-rated or out-of-service for an extended period of time.

39. While responsible entities will develop and implement operational procedures, NERC can support their efforts, for example, by identifying and sharing operational procedures found to be the most effective. NERC should also periodically survey the responsible entities' operational procedures, offer recommendations based on lessons-learned and new research findings, and re-evaluate whether modification to the Reliability Standards is warranted. Based on these surveys, NERC should produce periodic reports assessing the effectiveness of operational procedures. We take no position in this Final Rule on the content, frequency, or duration of such surveys, recommendations, or reports because we believe that those issues, in the first instance, should be addressed as part of the NERC standards development process.

40. We take no position in this Final Rule with respect to NERC's concerns regarding overreliance on the K-Index to trigger operational procedures. Technical issues regarding the development and implementation of operational procedures should be, in the first instance, considered in the NERC standards development process. Likewise, we take no position in this Final Rule on which functional entities should be responsible under the Reliability Standards because we believe that those issues, in the first instance, should be addressed as part of the NERC standards development process.

2. Schedule for Submitting and Implementing First Stage GMD Reliability Standards

NOPR

41. The NOPR proposed that NERC submit the First Stage GMD Reliability Standards to the Commission for

for Geo-Magnetic Disturbance (May 10, 2011), available at http://www.nerc.com/files/Order%20Analysis%20A-2011-05-10-01_GMD_FINAL.pdf.

[64] NERC Comments at 8; AEP Comments at 4–5; ELCON Comments at 13; SPP Parties Comments at 5; ISO Comments at 11; Consumers Comments at 8; and Duke Comments at 5.

[65] NOPR, 143 FERC ¶ 61,045 at P 10 n.38 (citing NERC Interim GMD Report at 79 ("Operating procedures are the quickest way to put in place actions that can mitigate the adverse effects of GIC on system reliability . . . . Both system operating and transmission owner organizations need to have appropriate procedures and training in place.")).

[66] See, e.g., ISO Comments at 5; Exelon Comments at 5; CEA Comments at 6–7; Dominion Comments at 6; Trade Associations Comments at 20.

[67] NERC Interim GMD Report at 80–81.

[68] NOPR, 143 FERC ¶ 61,045 at 20 (citing NERC Interim GMD Report at 79 ("The [operating] procedures of these organizations need to be coordinated with each other and with their neighboring organizations.")).

[69] In NERC's May 21, 2012 post-technical Conference comments, NERC stated that planning coordinators will conduct the wide-area analyses as part of the "Initial Actions" assessments discussed below. NERC May 21, 2012 Comments at 9. LADWP proposes that reliability coordinators coordinate these efforts. LADWP Comments at 3.

Directs NERC to submit a Reliability Standard within six months

Require owners and operators to develop and implement operational procedures to mitigate the effects of GMD

Coordinate the operational procedures across the regions

Consider operational procedures for restoring GMD impacted areas accounting for equipment that could be damaged and out of service

Complete and implement the operational plan within six months after approval of the standard

Stage Two

Part 1

30756 Federal Register / Vol. 78, No. 100 / Thursday, May 23, 2013 / Rules and Regulations

Standards that require owners and operators of the Bulk-Power System to conduct initial and on-going assessments of the potential impact of GMDs on Bulk-Power System equipment and the Bulk-Power System as a whole. The NOPR stated that the Reliability Standards would require owners and operators to develop and implement plans based on the needs identified in the assessments.

57. The NOPR proposed to direct the ERO to consider the following parameters as it develops the Second Stage GMD Reliability Standards.

58. First, the Commission proposed that the Reliability Standards should contain uniform evaluation criteria for owners and operators to follow when conducting their assessments.

59. Second, the NOPR stated that the assessments should, through studies and simulations, evaluate the primary and secondary effects of GICs on Bulk-Power System transformers, including the effects of GICs originating from and passing to other regions.[87]

60. Third, the NOPR asserted that the assessments should evaluate the effects of GICs on other Bulk-Power System equipment, system operations, and system stability, including the anticipated loss of critical or vulnerable devices or elements resulting from GIC-related issues.[88]

61. Fourth, in conjunction with assessments by owners and operators of their own Bulk-Power System components, the Commission stated that wide-area or Regional assessments of GIC impacts should be performed. The NOPR noted that a severe GMD event can cause simultaneous stresses at multiple locations on the Bulk-Power System, potentially resulting in a multiple-outage event.[89] In predicting GIC flows, it is necessary to take into consideration the network topology as an integrated whole [i.e., on a wide-area basis].[90]

62. Fifth, the NOPR proposed that the assessments should be periodically updated, taking into account new facilities, modifications to existing facilities, and new information, including new research on GMDs, to determine whether there are resulting changes in GMD impacts that require modifications to Bulk-Power System mitigation schemes.

Comments

63. NERC and several commenters generally support requiring GMD vulnerability assessments.[91] NERC states that it supports the NOPR's approach of requiring owners and operators of the Bulk-Power System to conduct vulnerability assessments to determine how critical or vulnerable Bulk-Power System components react to simulated GICs of varying intensities. NERC also states that it appreciates the NOPR's recognition of the need to incorporate new information and research given that the science of GMDs is still evolving.

64. Many commenters that oppose the Second Stage GMD Reliability Standards at this time state that available methods of performing vulnerability assessments are crude and unrefined.[92] For example, the Trade Associations state that using existing tools "would be asking industry to make assessments . . . and apply solutions at a point when these tools are incapable of doing so without creating risks to reliability that could be greater than any known risk resulting from a severe GMD event."[93] Commenters state that assessments should only be required after the necessary tools and methodologies have been developed and validated and the NERC GMD Task Force has completed its work.

65. Some commenters state that requiring all owners and operators to base their vulnerability assessments on uniform evaluation criteria would not be realistic due to the widely varying geology and geomagnetic latitudes within which the Bulk-Power System is planned and operated.

66. Some commenters state that the Commission should specify the severity of the GMD to assess and plan, although the commenters do not agree on a specific severity.[94] ITC states that it "believes that there should be a clear engineering benchmark for transmission owner and operators to plan for GMD in a prudent fashion [e.g., a 1 in 100 year GMD event]."[95] EIS states that, because the science of GMDs is inexact, an event twice as large as the largest expected GMD should be used as a safety margin.[96] Other commenters state that establishing a benchmark GMD event is problematic because there is no consensus storm scenario.

Commission Determination

67. We direct NERC, within 18 months of the effective date of this final rule, to submit for approval one or more Reliability Standards that require owners and operators of the Bulk-Power System to conduct initial and on-going vulnerability assessments of the potential impact of benchmark GMD events on Bulk-Power System equipment and the Bulk-Power System as a whole. We agree with commenters that the Second Stage GMD Reliability Standards should specify what severity GMD events (i.e., benchmark GMD events) responsible entities must assess for potential impacts on the Bulk-Power System. However, the Commission declines to specify the severity of the storm or otherwise define the characteristics of these benchmark GMD events in this Final Rule. Rather, NERC, through its standards development process, should identify the benchmark GMD events that responsible entities would have to assess.[97] Each responsible entity under the Second Stage GMD Reliability Standards would then be required to assess its vulnerability to the benchmark GMD events consistent with the five assessment parameters identified in the NOPR and adopted in this Final Rule.[98] The NERC standards development process should consider tasking planning coordinators, or another functional entity with a wide-area perspective, to coordinate assessments across Regions under the Second Stage GMD Reliability Standards to ensure consistency and regional effectiveness.

68. The comments that oppose requiring assessments stress that there is a substantial amount of work being done by the NERC GMD Task Force and industry to develop and validate tools, models, and data to perform the vulnerability assessments. We recognize that the tools for assessing GMD vulnerabilities are not fully mature. To address this concern, NERC should

[87] The NOPR described damage to Bulk-Power System components as a primary effect of GICs and production of harmonics that are not present during normal Bulk-Power System operation and increased transformer absorption of reactive power as secondary effects of GICs. NOPR, 141 FERC ¶ 61,045 at P 15.

[88] The Oak Ridge Study assessment included GMD modeling, simulations and review of storm impacts, power grid GIC flows and reactive power demands, transformer heating and risk of potential damage to transformers. See generally Oak Ridge Study 319 Report.

[89] Oak Ridge Study 319 Report at pages A1–1, A1–2.

[90] Id. at page 1–17.

[91] See, e.g., NERC Comments at 14; Joint EEIs/ETOs Comments at 10; PJM Comments at 3; Pa PUC Comments at 4–5; SLP Comments at 2.

[92] See, e.g., Trade Associations Comments at 20; Exelon Comments at 8.

[93] Trade Associations Comments at 4.

[94] See, e.g., GEA Comments at 4–5; ITC Comments at 4.

[95] ITC Comments at 4.

[96] EIS Comments at 4.

[97] Similar work is already being done in Phase 2 of the NERC GMD Task Force Plan. The GMD Task Force Phase 2 Scope and Project Plan states that the NERC GMD Task Force will "refine and improve a set of defined reference events (most severe occurrences in a 100-year time horizon) and support ongoing research to identify the maximum theoretical GMD." GMD Task Force Phase 2 Scope and Project Plan at 3.

[98] NOPR, 141 FERC ¶ 61,045 at PP 58–62.

Directs NERC to submit a Reliability Standard within 18 months

Requires owners and operators to conduct initial and on-going vulnerability assessments of the impact of a "benchmark" GMD event

Vulnerabilities assessments are to be consistent with five parameters

- Contain uniform evaluation criteria
- Evaluate primary and secondary effects including GIC originating from and passing to other regions
- Evaluate effects on other BPS equipment
- Conducted on wide area or regional basis
- Updated periodically

Stage Two

Part 2

Comments

75. NERC states that the Second Stage GMD Reliability Standards should be technology-neutral and should not require dedicated blocking devices or other specific equipment. NERC further states that it is currently unable to verify whether a specific blocking device is appropriate.

76. A majority of commenters state that blocking devices need further study and that the Commission should clarify that the Second Stage GMD Reliability Standards will not require responsible entities to install blocking devices or require installation of any particular type of mitigation.[105] Bonneville, for example, states that the "capability to perform studies that include transformer thermal models needed for developing appropriate mitigation plans and blocking strategies will likely not be available for use until the end of the 2014 at the earliest."[106] Commenters also express concern with the statement in the NOPR that plans for addressing GMD vulnerabilities cannot be limited to operational procedures or enhanced training alone because the commenters understand this language to require the installation of automatic blocking devices. PJM requests that the Reliability Standards explicitly state that equipment owners, not system operators, are the responsible entities.[107]

77. Some commenters state that the Second Stage GMD Reliability Standard should not require responsible entities to implement a plan that prevents cascading failures but instead support a Reliability Standard that allows NERC to determine the appropriate mix between prevention and timely restoration of the Bulk-Power System. Commenters also express concern with the language in the NOPR that, under the Second Stage GMD Reliability Standards, responsible entities would be required to "develop and implement a plan so that instability, uncontrolled separation, or cascading failures of the Bulk-Power System, caused by damage to critical or vulnerable Bulk-Power System equipment, or otherwise, will not occur as a result of a GMD." Commenters state that such a standard imposes strict liability on responsible entities and is inconsistent with the unpredictable and uncontrolled nature of GMD events.

78. Other commenters express support for hardening elements of the Bulk-Power System as an option to protect against GMD events.[108] Some of these commenters state that operational procedures alone do not prevent the flow of GICs through Bulk-Power System elements; instead, operational procedures are intended to prevent the Bulk-Power System from collapsing, which exposes equipment to GICs for longer periods. EIS states that a combination of operational procedures and hardware is needed to protect the Bulk-Power System. Foundation states that relying on operational procedures alone, based on warnings from space weather observations, renders the Advanced Composition Explorer satellite, which gives details about an approaching GMD, a single point of failure in protecting the Bulk-Power System. Commenters also state that the benefits afforded by operational procedures are unpredictable because the state of the Bulk-Power System (e.g., load, available generation, unplanned equipment outages) at the time of a GMD event cannot be known in advance.

Commission Determination

79. We direct NERC, within 18 months of the effective date of this Final Rule, to submit for approval one or more Reliability Standards that, assuming the assessments identify potential impacts from a benchmark GMD event, require owners and operators of the Bulk-Power System to develop and implement a plan to protect against instability, uncontrolled separation, or cascading failures of the Bulk-Power System, caused by damage to critical or vulnerable Bulk-Power System equipment, or otherwise, as a result of a benchmark GMD event. Owners and operators of the Bulk-Power System cannot limit their plans to considering operational procedures or enhanced training, but must, subject to the vulnerabilities identified in the assessments, contain strategies for protecting against the potential impact of any benchmark GMD event based on factors such as the age, condition, technical specifications, system configuration, or location of specific equipment. These strategies could, for example, include automatically blocking GICs from entering the Bulk-Power System, instituting specification requirements for new equipment, inventory management, and isolating certain equipment that is not cost effective to retrofit, or a combination thereof.

80. A major concern raised in the comments is that the NOPR proposed to require responsible entities to utilize automatic blocking devices. However, the NOPR explicitly stated that it did not propose to require a particular solution in the Second Stage GMD Reliability Standards to address GMD vulnerabilities. The NOPR only stated that it expected that some assessments will demonstrate that automatic blocking is necessary in some instances. While the NOPR proposed to provide guidance with respect to the use and evaluation of automatic blocking devices, the NOPR did not propose to require the use of automatic blocking devices.

81. In this Final Rule, we do not direct the ERO to develop Reliability Standards that require the use of automatic blocking devices or any specific technology. We agree with NERC that the Reliability Standards should be technology-neutral.[109] Instead, the Second Stage GMD Reliability Standards should require owners and operators of the Bulk-Power System to develop and implement a plan to protect against instability, uncontrolled separation, or cascading failures of the Bulk-Power System, caused by damage to critical or vulnerable Bulk-Power System equipment, or otherwise, as a result of a benchmark GMD event. In the NOPR, we identified a non-exhaustive list of possible automatic measures for doing so, including automatically blocking GICs from entering the Bulk-Power System, instituting specification requirements for new equipment, inventory management, and isolating certain equipment that is not cost effective to retrofit.

82. As with the First Stage GMD Reliability Standards, the responsible entities should perform vulnerability assessments of their own systems and develop the plans for mitigating any identified vulnerabilities. We take no position in this Final Rule on which functional entities should be responsible for compliance under the Second Stage GMD Reliability Standards. However, the NERC standards development process should consider tasking planning coordinators, or another functional entity with a wide-area perspective, to coordinate mitigation plans across Regions under the Second Stage GMD Reliability Standards to ensure consistency and regional effectiveness. We clarify that if a responsible entity performs the required GMD vulnerability assessments and finds no potential GMD impacts, no

[105] See, e.g., Trade Associations Comments at 32; Joint ISOs/RTOs Comments at 16; Bonneville Comments at 7; Exelon Comments at 11–12.

[106] Bonneville Comments at 6.

[107] PJM Comments at 4–5.

[108] See, e.g., PA PUC Comments at 4; Bonneville Comments at 7.

[109] NERC Comments at 4.

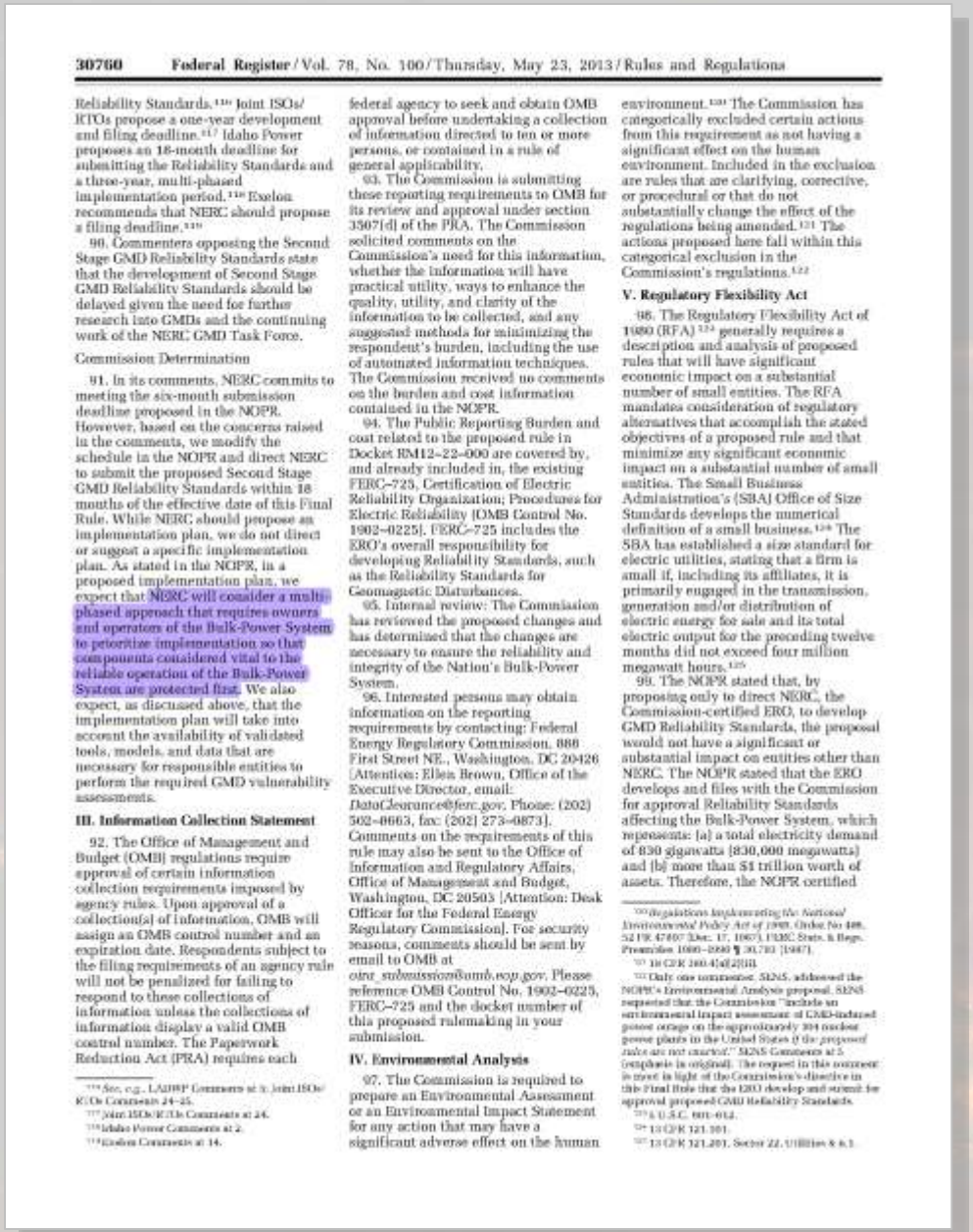
Directs NERC to submit a Reliability Standard within 18 months

Requires owners and operators develop and implement a plan to protect against instability, uncontrolled separation or cascading failures

Cannot limit the plans to operational procedures or enhanced training … but must contain strategies for protection against and benchmark GMD event

Stage Two

Part 2



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Reliability Standards.[116] Joint ISOs/RTOs propose a one-year development and filing deadline.[117] Idaho Power proposes an 18-month deadline for submitting the Reliability Standards and a three-year, multi-phased implementation period.[118] Exelon recommends that NERC should propose a filing deadline.[119]

90. Commenters opposing the Second Stage GMD Reliability Standards state that the development of Second Stage GMD Reliability Standards should be delayed given the need for further research into GMDs and the continuing work of the NERC GMD Task Force.

Commission Determination

91. In its comments, NERC commits to meeting the six-month submission deadline proposed in the NOPR. However, based on the concerns raised in the comments, we modify the schedule in the NOPR and direct NERC to submit the proposed Second Stage GMD Reliability Standards within 18 months of the effective date of this Final Rule. While NERC should propose an implementation plan, we do not direct or suggest a specific implementation plan. As stated in the NOPR, in a proposed implementation plan, we expect that NERC will consider a multi-phased approach that requires owners and operators of the Bulk-Power System to prioritize implementation so that components considered vital to the reliable operation of the Bulk-Power System are protected first. We also expect, as discussed above, that the implementation plan will take into account the availability of validated tools, models, and data that are necessary for responsible entities to perform the required GMD vulnerability assessments.

III. Information Collection Statement

92. The Office of Management and Budget (OMB) regulations require approval of certain information collection requirements imposed by agency rules. Upon approval of a collection(s) of information, OMB will assign an OMB control number and an expiration date. Respondents subject to the filing requirements of an agency rule will not be penalized for failing to respond to these collections of information unless the collections of information display a valid OMB control number. The Paperwork Reduction Act (PRA) requires each federal agency to seek and obtain OMB approval before undertaking a collection of information directed to ten or more persons, or contained in a rule of general applicability.

93. The Commission is submitting these reporting requirements to OMB for its review and approval under section 3507(d) of the PRA. The Commission solicited comments on the Commission's need for this information, whether the information will have practical utility, ways to enhance the quality, utility, and clarity of the information to be collected, and any suggested methods for minimizing the respondent's burden, including the use of automated information techniques. The Commission received no comments on the burden and cost information contained in the NOPR.

94. The Public Reporting Burden and cost related to the proposed rule in Docket RM12–22–000 are covered by, and already included in, the existing FERC–725, Certification of Electric Reliability Organization; Procedures for Electric Reliability [OMB Control No. 1902–0225]. FERC–725 includes the ERO's overall responsibility for developing Reliability Standards, such as the Reliability Standards for Geomagnetic Disturbances.

95. Internal review: The Commission has reviewed the proposed changes and has determined that the changes are necessary to ensure the reliability and integrity of the Nation's Bulk-Power System.

96. Interested persons may obtain information on the reporting requirements by contacting: Federal Energy Regulatory Commission, 888 First Street NE., Washington, DC 20426 [Attention: Ellen Brown, Office of the Executive Director, email: DataClearance@ferc.gov, Phone: (202) 502–8663, fax: (202) 273–0873]. Comments on the requirements of this rule may also be sent to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503 [Attention: Desk Officer for the Federal Energy Regulatory Commission]. For security reasons, comments should be sent by email to OMB at oira_submission@omb.eop.gov. Please reference OMB Control No. 1902–0225, FERC–725 and the docket number of this proposed rulemaking in your submission.

IV. Environmental Analysis

97. The Commission is required to prepare an Environmental Assessment or an Environmental Impact Statement for any action that may have a significant adverse effect on the human environment.[120] The Commission has categorically excluded certain actions from this requirement as not having a significant effect on the human environment. Included in the exclusion are rules that are clarifying, corrective, or procedural or that do not substantially change the effect of the regulations being amended.[121] The actions proposed here fall within this categorical exclusion in the Commission's regulations.[122]

V. Regulatory Flexibility Act

98. The Regulatory Flexibility Act of 1980 (RFA)[123] generally requires a description and analysis of proposed rules that will have significant economic impact on a substantial number of small entities. The RFA mandates consideration of regulatory alternatives that accomplish the stated objectives of a proposed rule and that minimize any significant economic impact on a substantial number of small entities. The Small Business Administration's (SBA) Office of Size Standards develops the numerical definition of a small business.[124] The SBA has established a size standard for electric utilities, stating that a firm is small if, including its affiliates, it is primarily engaged in the transmission, generation and/or distribution of electric energy for sale and its total electric output for the preceding twelve months did not exceed four million megawatt hours.[125]

99. The NOPR stated that, by proposing only to direct NERC, the Commission-certified ERO, to develop GMD Reliability Standards, the proposal would not have a significant or substantial impact on entities other than NERC. The NOPR stated that the ERO develops and files with the Commission for approval Reliability Standards affecting the Bulk-Power System, which represents: (a) a total electricity demand of 830 gigawatts (830,000 megawatts) and (b) more than $1 trillion worth of assets. Therefore, the NOPR certified

[116] See, e.g., LADWP Comments at 3; Joint ISOs/RTOs Comments 24–25.

[117] Joint ISOs/RTOs Comments at 24.

[118] Idaho Power Comments at 2.

[119] Exelon Comments at 14.

[120] Regulations Implementing the National Environmental Policy Act of 1969, Order No 486, 52 FR 47897 (Dec. 17, 1987), FERC Stats. & Regs. Preambles 1986–1990 ¶ 30,783 (1987).

[121] 18 CFR 380.4(a)(2)(ii).

[122] Only one commenter, SDG&E, addressed the NOPR's Environmental Analysis proposal. SDG&E requested that the Commission "include an environmental impact assessment of GMD-induced power outage on the approximately 104 nuclear power plants in the United States if the proposed rules are not enacted." SDG&E Comments at 5 (emphasis in original). The request in this comment is moot in light of the Commission's directive in this Final Rule that the ERO develop and submit for approval proposed GMD Reliability Standards.

[123] 5 U.S.C. 601–612.

[124] 13 CFR 121.101.

[125] 13 CFR 121.201, Sector 22, Utilities & n.1.

Directs NERC to submit a Reliability Standard within 18 months

Requires owners and operators develop and implement a plan to protect against instability, uncontrolled separation or cascading failures

Cannot limit the plans to operational procedures or enhanced training … but must contain strategies for protection against and benchmark GMD event

The order directs NERC to propose and implementation plan containing a multi-phased approach that requires prioritizes implementation so that components considered vital to the operation of the BPS are protected first.

SUMMARY

The GMD Order has a two stage approach:

- First stage – an interim step consisting of operating procedures that can afford some degree of protection
- Second stage – system wide assessment and the development and implementation of a plan that protects against instability, uncontrolled separation or cascading failures as a result of a “benchmark” GMD event.

Stage one standards to be submitted by January 22, 2014
Stage two standards to be submitted by due January 22, 2015